Ontario Geological Survey

Report 196

Geology of

Emo, Rhodes, and Bo[illegible]a Townships

District of Sudbury

By

Burkhard O. Dressler

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Geological Map

(back pocket)

Map 2413 (coloured)–Emo, Rhodes, and Botha Townships, Sudbury District.
Scale 1:31 680 or 1 inch to ½ mile.

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

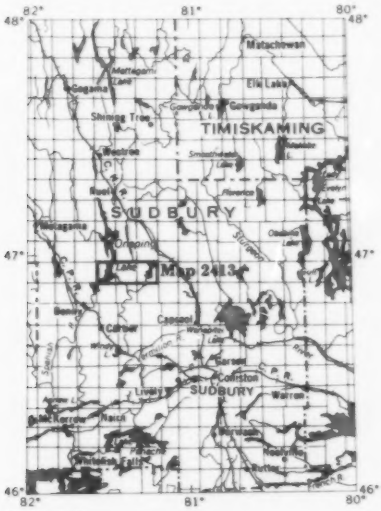
1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/ton (short)

NOTE–Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in co-operation with the Coal Association of Canada.

ABSTRACT

Emo, Rhodes, and Botha Townships are located about 51 km northwest of the city of Sudbury and cover approximately 280 km².

Mapping at a scale of 1 inch to ¼ mile (final map 1:31 680 or 1 inch to ½ mile) shows that the area is underlain by Precambrian metamorphic, igneous, and sedimentary rocks.



SMC 14145

Figure 1–Key map showing location of Emo, Rhodes, and Botha Townships. Scale 1:3 168 000 (1 inch to 50 miles).

Early Precambrian (Archean) gneisses and metavolcanics with sedimentary interbeds are the oldest rocks exposed and are intruded by granitic rocks. Early Precambrian mafic dikes are numerous throughout the area.

Middle Precambrian sedimentary rocks of the Huronian Supergroup overlie the older rocks unconformably. Only the sedimentary rocks of the Gowganda and Lorrain Formations are present in the area.

Gabbroic bodies, the "Nipissing Diabases", have intruded the Huronian and older rocks.

Breccias and pseudotachylites are common and are possibly related to the Sudbury Event, either explosive volcanism or impact of a meteorite.

Olivine diabases are the youngest rocks in the area. They were emplaced in tensional fracture zones.

Pleistocene glaciation resulted in removal of soil and in local deposition of till, sand, and gravel.

Folding occurred mainly before the emplacement of the Early Precambrian granitic rocks. Faulting has effected all the rocks of the map-area.

There are no producing mines in the region. The area, however, is of a certain economic interest and exploration has been carried out during the past thirty years. The region is favourable for exploration for iron, lead, zinc, and copper.

Geology

of

Emo, Rhodes, and Botha Townships

District of Sudbury

by

Burkhard O. Dressler[1]

INTRODUCTION

Location and Access

Emo, Rhodes and Botha Townships, comprising approximately 280 km^2, are located about 51 km northwest of the City of Sudbury in the Sudbury Mining Division (Figure 1). They are bounded by Latitudes 46°53′20″N and 46°58′30″N and Longitudes 81°12′05″W and 81°34′55″W.

Access to Emo Township is provided by Highway 144 from Sudbury and a gravel road to Lower Onaping Lake. Two thirds of Rhodes and Botha Townships are accessible by four-wheel drive vehicle via a network of logging roads. The intersection of the latter with Highway 144 is about 13 km northwest of Cartier. The northern sector of Rhodes Township is accessible only by float-equipped aircraft.

Mapping Method

Mapping was carried out over a period of four months during the summer of 1975. Pace-and-compass traverses were run at approximately 0.4 km intervals between topographic points. Outcrops along lakeshores and roads were also examined. Data gathered during field work were plotted on transparent overlays on aerial photographs and transferred to base maps of the same scale as the ae-

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Toronto. Manuscript approved for publication by the Chief Geologist. March 16, 1977.
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rial photographs (1:15 840). Air photographs were supplied by the Division of Forests and base maps were supplied by the Division of Lands, Ministry of Natural Resources.

Acknowledgments

The author was assisted in the field by S. Themistocleous, J. Ernsting, S. Bigras, and J. Chasse. S. Themistocleous is responsible for mapping about half of the map-area.

Previous Geological Work

The first geological work in the area was done by Robert Bell. During the period 1880-1890 he investigated the Sudbury map-area. His report (Bell 1890-1891) contains descriptions of the rocks seen along Onaping Lake.

W.H. Collins (1917) mapped the Onaping map-area. His map is at a scale of 4 miles to 1 inch and includes the present area.

The following geological reports on neighboring townships, including geological maps at a scale of ½ mile to the inch, have been published:

K.D. Card and H. Meyn, (1969): Geology of the Leinster-Bowell Area.

H. Meyn (1971): Geology of Roberts, Creelman, and Fraleck Townships.

H. Meyn (1973a): Geology of Sweeny, Beaumont, and Beresford Townships.

A preliminary geological compilation map (Card 1967) has been issued by the Ontario Department of Mines. It includes the present area.

The area is also covered by aeromagnetic maps of the Geological Survey of Canada, Venetian Lake Sheet, Map 1519G (GSC 1965a) and Pogamasing Sheet, Map 1525G (GSC 1965b).

Preliminary geological maps of the present area have been published in 1976 (Dressler 1976a, b, c).

Physiography

The map-area is part of the southern Canadian Shield and has characteristically low relief. The general elevation is about 450 m above sea level and the average topographic relief is approximately 30 to 100 m.

The topography is controlled largely by bedrock lithology and unconsolidated surficial deposits. The Early Precambrian granitic rocks and the quartz sandstones of the Lorrain Formation are in general resistant to erosion and form high, in places, barren ridges. The Early Precambrian metasediments and metavolcanics and the siltstones and conglomerates of the Gowganda Formation are

less resistant to erosion and are at lower elevation. The unconsolidated Pleistocene and Recent deposits form flat plains, for example in southern Rhodes and Botha Townships.

Lakes and swamps are numerous. The regional drainage is to the south via small streams. Only the Onaping River, between Onaping and Kasakawawia Lakes, is suitable for canoe travel.

GENERAL GEOLOGY

The area is underlain by Precambrian rocks which range in age from more than 2,500 m.y. to about 1,100 m.y. Pleistocene and Recent unconsolidated sediments cover the bedrock in many places.

Early Precambrian gneisses, metasediments, metavolcanics, and metagabbros are the oldest rocks in the area. These rocks occur as remnants of a formerly continuous belt in predominantly granitic terrain and range in size from less than 1 square metre to more than several square kilometres.

The metavolcanics and metasediments are intruded by the granitic rocks which were emplaced approximately 2,500 m.y. ago, during the Kenoran Orogeny (Van Schmus 1965; Fairbairn *et al.* 1960).

Early Precambrian mafic dikes are numerous throughout the area. They are younger than the granitic intrusions but older than the deposition of the supracrustal Huronian sediments.

Middle Precambrian sediments of the Huronian Supergroup overlie the older rocks unconformably and in many places are in fault contact with the basement rocks. They are from 2,200 to 2,500 m.y. old (Van Schmus 1965; Fairbairn *et al.* 1967, 1969), which corresponds to the Aphebian of Stockwell (1964). The Huronian rocks are remnants of a former, probably continuous sedimentary cover. Only conglomerates, arkoses, and siltstones of the Gowganda Formation and sandstones and conglomerates of the Lorrain Formation occur in the present area.

Nipissing Diabases have intruded all the older formations. They are about 2,160 m.y. old (Van Schmus 1965; Fairbairn *et al.* 1969).

Pseudotachylites and breccias are common mainly in the southern parts of the map-area. They are possibly related to the Sudbury Event, either explosive volcanism or an impact of a meteorite (Fairbairn and Robson 1941; Speers 1957; French 1968).

Late Precambrian olivine diabases are the youngest rocks in the area. Radiometric age determinations (Fairbairn *et al.* 1960; Van Schmus 1965) indicate that they are about 1,100 million years old.

The rock units of the area are shown in the Table of Lithologic Units (Table 1).

TABLE 1 TABLE OF LITHOLOGIC UNITS FOR EMO, RHODES, AND BOTHA TOWNSHIPS

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Fluvial and glacial clay, sand and gravel; swamp deposits

Unconformity

PRECAMBRIAN

MIDDLE TO LATE PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

Olivine diabase

Intrusive Contact

MIDDLE PRECAMBRIAN

SUDBURY-TYPE BRECCIA, PSEUDOTACHYLITE AND ULTRAMYLONITE

Sudbury-type breccia, pseudotachylite, and ultramylonite

MAFIC INTRUSIVE ROCKS

NIPISSING DIABASE

Quartz diabase

Intrusive Contact

HURONIAN SUPERGROUP

COBALT GROUP

LORRAIN FORMATION

Quartzitic sandstone, conglomerate, and minor siltstone

GOWGANDA FORMATION

Conglomerate, quartz sandstone, arkose, siltstone, and minor argillite

Unconformity

EARLY PRECAMBRIAN

MAFIC INTRUSIVE ROCKS

Diabase, glomeroporphyritic diabase

Intrusive Contact

FELSIC INTRUSIVE AND MIGMATITIC ROCKS

Gneissic, porphyritic and equigranular granitic rocks, aplite pegmatite, and aplite and migmatite

METAVOLCANICS AND METASEDIMENTS

INTERMEDIATE TO FELSIC METAVOLCANICS

Felsic and intermediate flows and tuffs, quartz porphyry

MAFIC METAVOLCANICS

Amphibolite; pillowed flows; tuffs and agglomerates

METASEDIMENTS

Siltstone, sandstone, conglomerate, iron formation, and biotite-plagioclase gneisses.

Early Precambrian

METAVOLCANICS AND METASEDIMENTS

Metasediments

The Early Precambrian (Archean) metasediments can easily be distinguished from the sedimentary rocks of the Huronian Supergroup. In contrast to the Huronian rocks they are, in places, intruded by pegmatite dikes, veins, or larger granitic bodies, or follow the general trend of the metavolcanics. In thin section the metasediments show a stronger saussuritization of plagioclase and a stronger chloritization of biotite than do the Huronian rocks. A plagioclase metablastesis was observed only in the Archean metasediments.

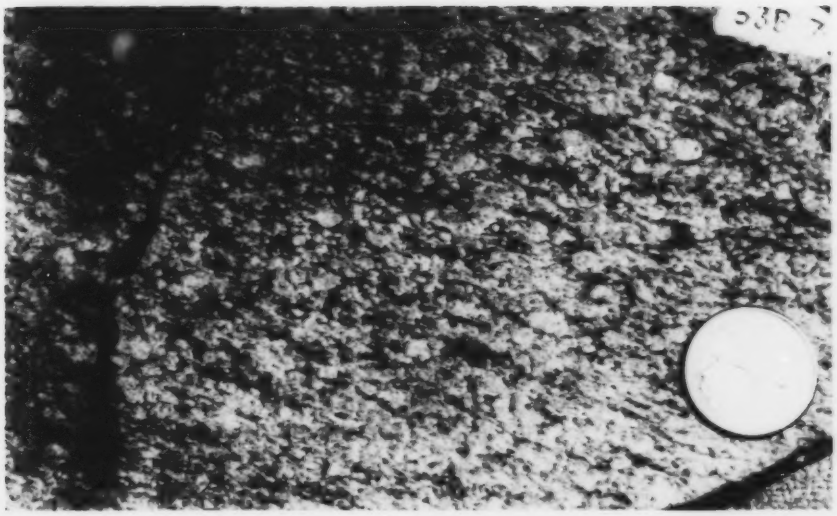
BIOTITE-PLAGIOCLASE GNEISSES

Biotite-plagioclase gneisses of granodioritic and granitic to monzonitic composition occur in southern Rhodes and Botha Townships, generally south of the metavolcanic suite of Early Precambrian rocks.

The gneisses are fine to medium grained and grey, dark grey or pinkish on fresh surface. Commonly they are mylonitic, showing feldspar clasts or augen up to 5 mm, rarely 8 mm, in size set in a finer grained matrix. In hand specimen the rocks therefore commonly exhibit a typical pearly texture (Mehnert 1968, p.68) (Photo 1).

The study of thin sections substantiates the macroscopic observations. The subrounded felspar clasts i.e. the "pearls" are mostly twinned, in places zoned and commonly saussuritized plagioclase (An_5). Microcline clasts and augen also occur but are uncommon. Biotite is recrystallized and curves around the augen. A weak retrograde metamorphism is indicated by a partial chloritization of the mica. Quartz shows straight or slightly curved boundaries against quartz and curved boundaries against feldspar. Weakly radioactive epidote is a common rock-forming constituent. Accessory minerals are sphene, zircon, and opaque minerals.

The origin and the age of the gneisses is not known. The common interlayering of amphibolite beds within the gneisses and parallel to the gneissosity, however, suggest a sedimentary origin. The amphibolite beds within the gneisses are fine- to medium-grained, dark grey, dark greenish grey-weathering rocks which do not exhibit any original textures that would suggest their classification as pyroclastic rocks or as volcanic flows. It is to be noted, that the degree of deformation of the gneisses seems to be stronger than the deformation of the Early Precambrian (Archean) metasediments associated with the metavolcanics and described in the following section of this report. If this difference is conclusive the gneisses possibly represent part of a basement on which the Early Precambrian metavolcanic sequence was deposited.



OGS 10,129

Photo 1–Hand specimen of "pearly" biotite-plagioclase gneiss. Specimen 53B7. Location: easting 480260; northing 5195940.

SILTSTONE AND SANDSTONE

These Early Precambrian metasediments form discontinuous bands in the metavolcanics and are found in all three townships. The most common metasediments are siltstones and fine-grained sandstones. Only one outcrop of conglomerate was found.

Metamorphosed Early Precambrian siltstones and sandstones were observed mainly in the southern parts of all three townships.

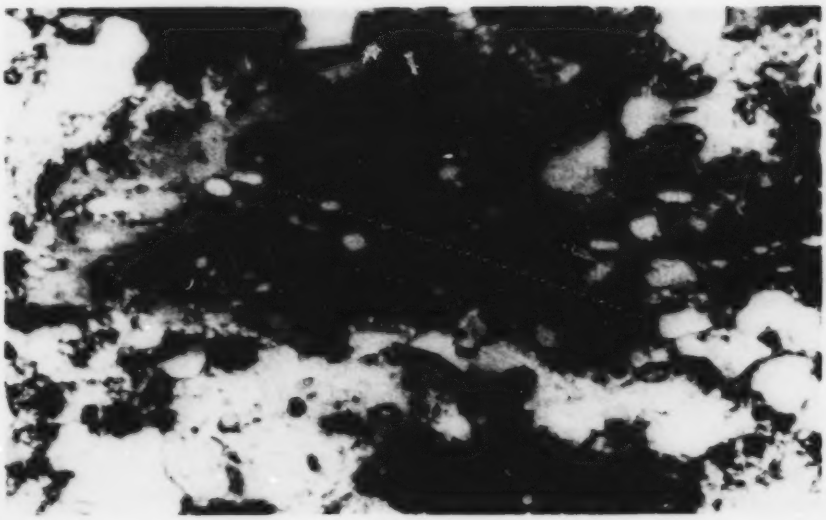
The siltstones (grain size about 0.01 to 0.1 mm) are commonly laminated and grey, light grey, or pinkish in colour. Sedimentary features such as crossbedding, convolute bedding, and graded bedding were not observed. The rocks weather grey, pinkish, or rusty brown. In one place, i.e. on the western shore of Onaping Lake a dark pyrite-rich schist is interlayered with the siltstone. Modal analyses are presented in Table 2. Further classification is difficult, for it is commonly not possible to distinguish between a fine chloritic and sericitic matrix (grain size <0.03 mm) and a secondary alteration of fine grains of feldspar.

The sandstones (grain size 0.1 to 1.5 mm) are commonly laminated arkoses. They are dark grey and weather grey or pinkish. Two modal analyses are shown in Table 2.

In thin section the Early Precambrian (Archean) clastic metasediments are composed of quartz, plagioclase (An_{05-10}), microcline, biotite, epidote, chlorite, and opaque minerals. Hornblende, muscovite, sphene, and carbonate also occur

TABLE 2 | MODAL ANALYSES OF EARLY PRECAMBRIAN METASEDIMENTS.

Rock Type	SILTSTONES					SANDSTONES	
Sample Number	10A33	55A10B	55A10D	56A3	56A4	44A32	64A12
Quartz	34.9	—	32.3	37.1	34.6	54.1	34.7
Plagioclase	39.5	—	29.1	51.4	50.3	34.0	3.2
Microcline	11.9	—	—	—	7.1	0.1	3.2
Hornblende	—	12.0	—	—	—	—	2.2
Biotite	5.8	5.7	14.7	—	1.3	1.2	0.7
Muscovite	2.4	—	—	—	—	—	5.9
Sphene	0.2	—	0.6	—	0.1	—	0.6
Opaque ore	1.0	4.3	8.2	0.1	—	—	0.6
Epidote	4.1	—	14.9	2.1	32.1	10.6	40.7
Chlorite	0.2	—	0.1	9.3	2.5	—	8.2
Carbonate	—	—	0.1	—	—	—	—
Fine Matrix	—	78.0	—	—	—	—	—
Location							
Easting	471450	481300	481300	469350	469430	479960	460740
Northing	5195060	5200300	5200300	5196700	5196750	5197480	5196190



OGS 10,130

Photo 2–Photomicrograph of metablastic plagioclase with many quartz inclusions. Metasiltstone. Thin section 56A3. Crossed nicols. Scale 0.2 mm. Location: easting 469350; northing 5196700.

but are uncommon (Table 2). The light minerals form a granoblastic mosaic. Biotite is light brown, brown or greenish brown and commonly forms an open fabric. Metablastic plagioclase as seen in Photo 2 was observed in thin sections from two localities.

CONGLOMERATE

A paraconglomerate of probable Early Precambrian (Archean) age was found on a tiny island in Venetian Lake (easting 481120; northing 5198800; Botha Township) in an area predominantly underlain by quartz porphyry. Early Precambrian and Huronian metasediments both occur close by. The rock was classified as Early Precambrian because the pebbles within the rock are deformed whereas the pebbles of the Huronian conglomerates are not. The pebbles are granitic and gabbroic, up to about 5 cm in size and show no sorting or packing. The matrix is a fine-grained, non laminated arkose.

OGS 10,131

Photo 3–Banded magnetite iron formation. Darker grey bands are magnetite-rich. Outcrop 9A. Location: easting 469340; northing 5196510.

IRON FORMATION

Iron formation occurs in two locations in Emo Township, west of Richardson Lake in Rhodes Township, and west of McGrindle Lake in Botha Township. Close to Sandfly Lake, Botha Township, and north of Bennet Lake, Rhodes Township, iron formation is indicated by aeromagnetic anomalies but no exposures were encountered in the densely overgrown terrain. The iron-bearing rocks are part of "The Iron Belt West of Hutton Township" examined first by M.T. Culbert in 1903 (Culbert 1904).

The iron formation occurs as lenses and bands in the metavolcanic rocks and is essentially Algoma-type magnetite-chert iron formation (Gross 1965). At one location, i.e. west of Richardson Lake (easting 469340; northing 5196510), very minor disseminated pyrite was observed in a magnetite-rich bed. The magnetite-bearing beds pinch and swell a little along strike but are commonly continuous over an outcrop. Sedimentary textures, except bedding and a fine lamination, are absent.

Single magnetite-rich beds range from 90 cm to a few millimetres thick and are interlayered with amphibolites, epidote-rich bands, and quartz-rich layers (Photo 3). The magnetite-rich beds themselves exhibit a fine compositional

banding that is 0.1 to 10 mm thick. In thin section it is seen to consist of bands of the following compositions in order of abundance:

common green hornblende, magnetite, little quartz;
quartz, magnetite, and little hornblende;
magnetite and little or no quartz.

West of Richardson Lake (easting 469340; northing 5196510) the following banding was observed:

common green hornblende, magnetite, minor epidote and quartz;
epidote, magnetite, minor hornblende;
epidote, minor magnetite, grunerite, and stilpnomelane;
grunerite, magnetite, minor hornblende, and quartz.

Magnetite is xenomorphic to idiomorphic; all other minerals are xenomorphic. Quartz forms a granoblastic mosaic. Individual quartz grains are 0.02 to 0.2 mm in size.

An outcrop of iron formation west of Richardson Lake was studied in some detail and a section across it was measured. The results are shown in Figure 2.

Metavolcanics

Metavolcanics mainly occur in the centres and in the southern halves of all three townships. In addition there are numerous small inclusions of metavolcanics within granitic rocks and in migmatites.

MAFIC METAVOLCANICS

The mafic metavolcanics comprise flows, tuffs, and agglomerates. Primary textures and structures are rarely preserved. Pillowed metabasalt was observed just west of Richardson Lake (Rhodes Township) (easting 470610; northing 5195760; and easting 470720, northing 5195700). The pillows are up to 5 by 50 cm in size and strongly deformed. Tuffs, crystal tuffs, and agglomerates were recognized in a few places, for example west of Richardson Lake (easting 470110, northing 5196010)and in north-central Botha Township (easting 482260, northing 5200120), but nowhere was it possible to follow and to map in detail individual volcanic horizons. The mafic metavolcanics therefore are mostly shown as "amphibolites" on the map that accompanies the present report (Map 2413; back pocket). This "amphibolite" unit also includes Archean metagabbros that are associated with the metavolcanic-metasedimentary suite of rocks about 2.4 km west of Richardson Lake.

The most common mafic metavolcanic is a fine-grained to medium-grained, dark green or almost black, weakly foliated amphibolite. Banded varieties (amphibolitic gneiss) exhibit a fine compositional layering of hornblende-rich and plagioclase-rich bands that are about 1 to 5 mm thick.

In thin section the mafic metavolcanics are seen to be composed of hornblende and plagioclase with variable amounts of quartz, biotite, epidote, sphene, leucoxene, chlorite, and opaque minerals. Nematoblastic, granoblastic, and

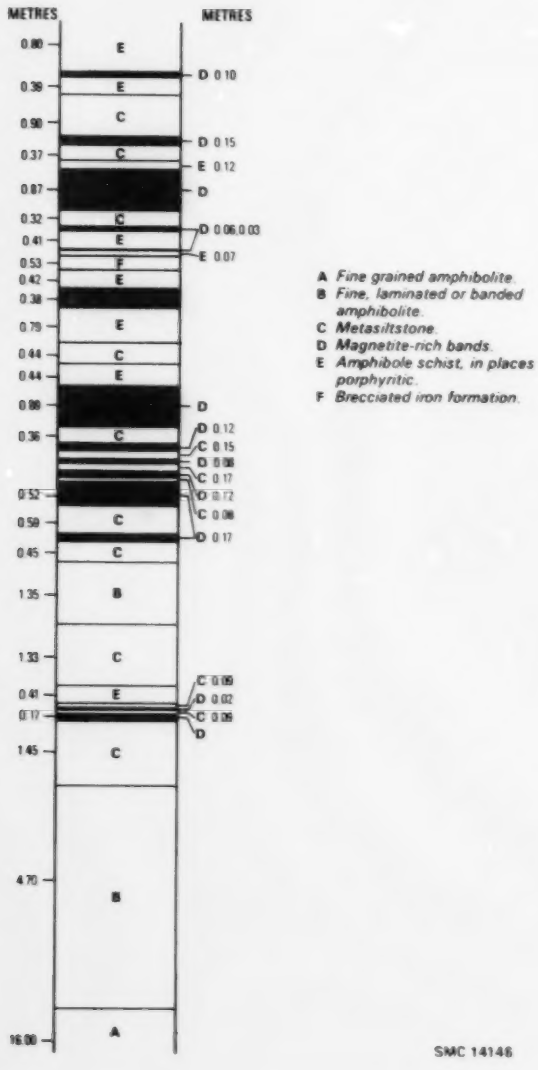
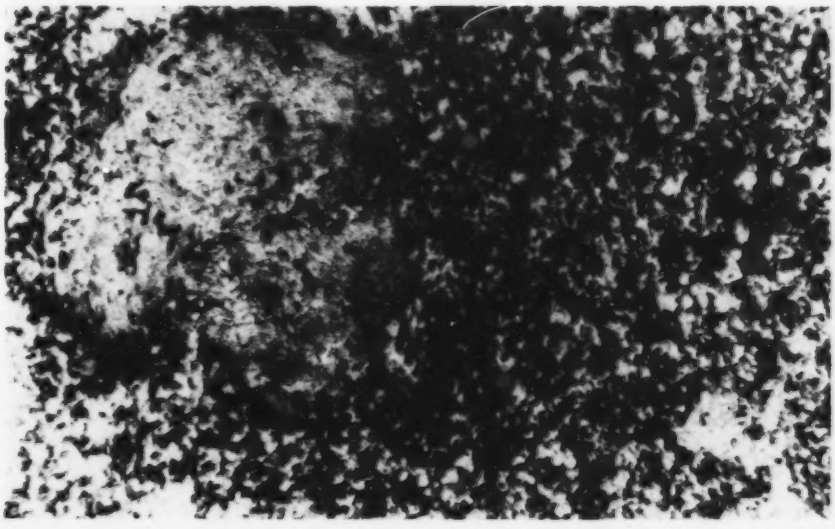


Figure 2–Iron formation west of Richardson Lake, Rhodes Township. Location: easting 469340; northing 5196510.



OGS 10,132

Photo 4–Photomicrograph of meta-crystal tuff. Volcanic crystals are completely replaced by decussate aggregates of hornblende. Thin section 5A13. Plane light. Scale 0.2 mm. Location: easting 468100; northing 5195900.

dense felt-like textures were observed. The large crystals in the crystal tuff are completely replaced by decussate aggregates of hornblende (Photo 4). The Table 3 shows modal analyses of amphibolites and Table 4, three chemical analyses.

INTERMEDIATE TO FELSIC METAVOLCANICS

Quartz porphyries and subordinate fine-grained or aphanitic felsic and intermediate metavolcanics were observed in all three townships. The quartz porphyries underlie rather large sections of central Rhodes and north-central Botha Townships. Fine-grained or aphanitic felsic and intermediate metavolcanics were found rarely and then only in small patches.

Quartz Porphyry

Quartz porphyries occur in all three townships. In Emo Township they were found near the outlet of Onaping Lake and in several places they are present as inclusions in the granitic rocks. In Rhodes Township quartz porphyry underlies

TABLE 3 | MODAL ANALYSES* OF METAVOLCANICS.

Rock Type	Amphibolite			Quartz Porphyry		Intermediate to felsic metavolcanics	
Specimen Number	54A7B	54A12	5B17B	3A31	3A32	43A5A	8A3
Quartz	1.5	—	2.5	38.1	41.1	34.8	35.8
Plagioclase	25.1	36.3	22.3	31.9	18.3	41.5	37.5
Microcline	—	—	—	23.6	19.9	1.3	13.5
Hornblende	13.3	49.3	55.9	—	—	0.1	0.3
Biotite	29.3	—	—	4.8	0.8	16.3	4.7
Epidote	15.6	—	18.7	0.3	—	2.0	5.6
Muscovite	—	—	—	1.3	19.9	3.7	1.4
Sphene	—	—	0.4	—	—	TR	—
Chlorite	—	1.1	TR	—	—	TR	—
Opaque Minerals	15.2	13.3	0.2	—	—	0.3	1.1
Plagioclase composition			Strong Saussuritization, An 00-10				
Location**							
Easting	483140	484000	468410	469680	470220	478950	471550
Northing	5196940	5196600	5197150	5198300	5197800	5197950	5195250

*The modal compositions presented in this report were obtained using a Rathenow Eltinor 4 point counter and counting a minimum of 2,000 points per rock thin section.

**Easting and northing from topographic maps 1:50 000 produced by the Federal Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa. (Maps 41I/14 E and W, 1962; 41I/13, provisional, 1967.

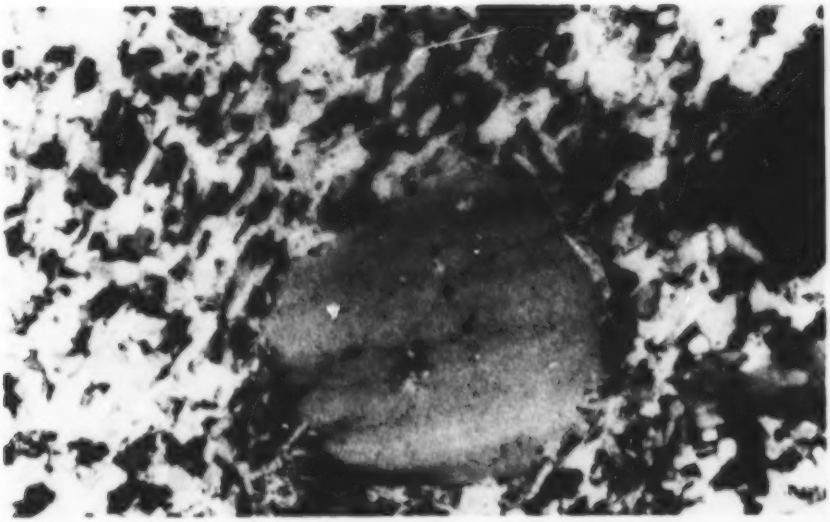
TABLE 4 | CHEMICAL ANALYSES OF METAVOLCANICS.

Rock Type	Mafic Metavolcanics			Felsic Metavolcanics		Quartz Porphyry
Specimen Number	4A14B	5A11	29A7B	14A12	43A5B	3A32
SiO_2	53.50	51.70	54.10	73.00	72.70	78.10
TiO_2	1.04	0.83	0.78	0.36	0.28	0.08
Al_2O_3	14.50	12.70	13.30	13.50	14.50	11.80
Fe_2O_3	7.21	11.70tot.	8.90tot.	3.54tot.	1.24	1.26tot.
FeO	3.49	n.d.	n.d.	n.d.	0.16	n.d.
MnO	0.26	0.23	0.16	0.05	0.02	0.02
MgO	5.29	6.39	7.88	0.77	0.34	0.98
CaO	8.42	10.70	8.14	0.81	0.83	0.63
Na_2O	3.32	2.29	2.99	3.19	6.22	1.48
K_2O	1.41	1.80	2.91	3.74	2.40	4.82
H_2O^+	0.89	1.47	n.d.	n.d.	0.14	n.d.
H_2O^-	0.60	n.d.	n.d.	n.d.	0.35	n.d.
P_2O_5	0.32	0.25	0.34	0.08	0.03	0.04
CO_2	0.13	n.d.	n.d.	n.d.	0.58	n.d.
S	0.00	n.d.	n.d.	n.d.	0.24	n.d.
L.O.I.			1.07	1.15		1.07
Total	100.4	100.1	100.6	100.2	100.0	100.3
Location						
Easting	468590	468280	467830	476550	478950	470220
Northing	5196390	5195950	5191600	5199500	5197970	5197800

an area north-northwest and east of Richardson Lake. In Botha Township it was found mainly on the islands in north-central Venetian Lake. In all places the strike of the quartz porphyries is parallel to the strike of the mafic metavolcanics.

The typical quartz porphyry of the area is a grey, light grey weathering rock. Round or almost round quartz phenocrysts are up to 4 mm in size and set in a very fine grained, weakly foliated groundmass. In several places microcline phenocrysts of approximately the same size as the quartz grains were also observed. Strongly deformed quartz porphyries are darker grey and show a well developed schistosity. In most of these deformed rocks the quartz phenocrysts can still be recognized. Layers of intermediate tuffaceous rocks are intercalated in the quartz porphyries in a few places. They are 0.30 m to, rarely, 3 m thick.

In thin section (Photo 5) the rocks are seen to be composed of quartz, plagioclase, microcline, muscovite, and minor amounts of biotite and radioactive epidote. Muscovite and biotite form an open fabric in a granoblastic-polygonal mosaic of the other minerals. Grain boundaries of quartz and feldspars are mostly slightly curved. Biotite is very light brown to brown, muscovite pale greenish. The quartz phenocrysts are xenomorphic and somewhat strained showing a wavy extinction. In Table 3, two modal analyses of quartz porphyries are shown



OGS 10,133

Photo 5–Photomicrograph of recrystallized quartz porphyry. Thin section 3A32. Crossed nicols. Scale 0.2 mm. Location: easting 470220; northing 5197800.

and in Table 4 a chemical analysis is presented. There is no conclusive evidence for or against an extensive or low level intrusive origin for the quartz porphyry. The porphyritic texture is characteristic of a rapidly cooled rock, i.e. characteristic of an extrusive or a low level intrusive rock. However, there is some evidence suggestive of an extrusive origin. North of Richardson Lake (Rhodes Township) the quartz porphyry is present in a large area, 1.2 by 3.6 km and the characteristic porphyritic texture is present all over this area. Characteristic intrusive textures are absent in the centre of this large igneous body. This feature, the presence of intercalated tuffaceous beds, and the occurrence of the quartz porphyries as rock units that in general follow the trend of the Early Precambrian mafic metavolcanics and metasediments are suggestive of an extrusive origin.

Intermediate and Felsic Flows and Tuff

Fine-grained or aphanitic, grey, light grey weathering intermediate metavolcanics occur intercalated with the mafic volcanic rocks but are uncommon. All primary structures and textures have commonly been obliterated by a well developed schistosity. However, in a few places, for example north of Richardson Lake in Rhodes Township, a fine possibly primary and sedimentary lamination is present.

In thin section the intermediate metavolcanics are seen to be composed of a granoblastic, panxenomorphic mosaic of plagioclase, microcline, quartz, with varying amounts of hornblende, biotite, epidote, chlorite, sphene and opaque minerals. The hornblende is a common green hornblende. Biotite is brown to very light brown. A modal analysis (specimen 8A3) is presented in Table 3.

Felsic metavolcanics, i.e. rhyolite and rhyolitic tuff were noted in only three places, all in Botha Township, i.e. 0.8 km east of southern Friday Lake, 2.4 km east of central Friday Lake, and west of Venetian Lake in central Botha Township. They are very fine grained or aphanitic, commonly structureless, grey, and weather light grey. Only at the occurrence west of Venetian Lake are the rocks laminated and not too fine grained for a microscopic examination. They are seen to consist of more or less the same minerals as the intermediate metavolcanics and these minerals, in like manner, form a similar panxenomorphic, granoblastic mosaic.

FELSIC INTRUSIVE AND MIGMATITIC ROCKS

Granitic Rocks

The granitic rocks in the map-area are predominantly of granodioritic to quartz monzonitic composition. These rocks were subdivided for mapping purposes into three types on the basis of structure and grain size. The three types are:

a) Pale pinkish, medium-grained and in many places gneissic "granite".
b) Coarse-grained, pink, porphyritic "granite".
c) Medium-grained, pink "granite".

GNEISSIC GRANITIC ROCKS

In the southern parts of the map-area pink, light pinkish weathering medium-grained granodioritic to quartz monzonitic rocks occur that are gneissic in many places.

In thin section the equigranular, panxenomorphic rocks show a normal granitic composition of quartz, microcline, plagioclase, and biotite. Quartz shows undulatory extinction. Microcline is perthitic and includes quartz, plagioclase, biotite, and accessory minerals. Plagioclase is commonly zoned and partly altered to saussurite. Biotite is greenish brown to very light brown and includes such weakly radioactive accessory minerals as zircon, apatite, and pleochroic sphene. Opaque minerals make up 0.1 to 0.2 percent of the rock and secondary minerals are chlorite, sericite, and epidote. Epidote is weakly radioactive. Table 5 shows the modal composition of two specimens and the rock names according to the Ontario Division of Mines classification of granitic rocks (Ayres 1972) and the rock names in the international classification of the I.U.G.S. Subcommission of the Systematics of Igneous Rocks (Streckeisen 1974).

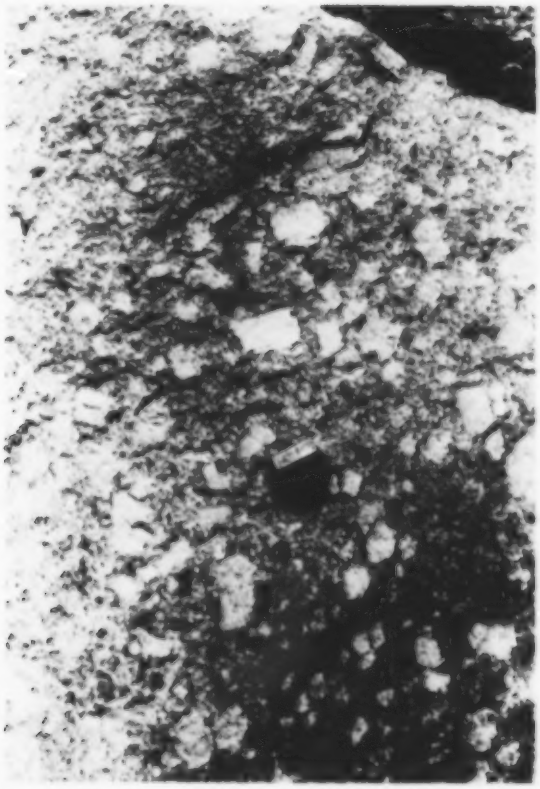


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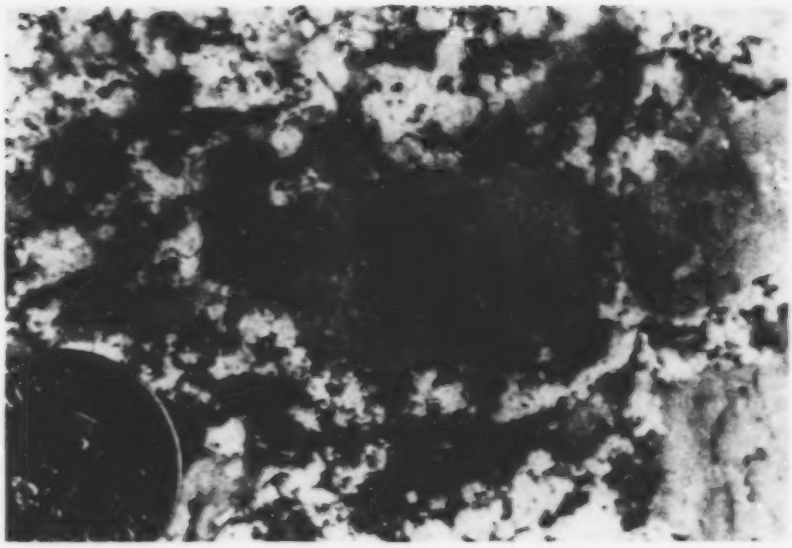
Photo 6–Porphyritic granite. Location: easting 463480; northing 5196890.

PORPHYRITIC GRANITIC ROCKS

The porphyritic, granodioritic to quartz monzonitic rocks occur in Emo and Rhodes Townships and form an approximately east-west striking band, 0.8 to 3.2 km wide. In general this band lies south of a younger, medium-grained, equigranular granitic mass and north of the older metavolcanic-metasedimentary units.

The rock contains up to 15 percent by volume phenocrysts of Carlsbad-twinned, idiomorphic microcline that ranges in size from 0.5 to 3 cm. In many places the alignment of the phenocrysts is suggestive of flow lines (Photo 6) and the alignment is roughly parallel to the regional trend of the granite band. Photo 7 shows a single, zoned potassic feldspar.



OGS 10,135

Photo 7–Zone potassic feldspar. Location: easting 463480; northing 5196890.

In thin section the rock is seen to be composed of quartz, plagioclase, microcline, hornblende, biotite, chlorite, epidote, and opaque minerals. Quartz shows undulatory extinction. Plagioclase is xenomorphic to hypidiomorphic and commonly partly altered to saussurite. Microcline is perthitic and forms large phenocrysts and about 30 percent by volume of the medium- to coarse-grained matrix of the rock. The hornblende is a common green hornblende and biotite is light greenish brown and partly or completely altered to chlorite. The epidote is a xenomorphic yellowish green pistacite.

To obtain a reliable modal composition (Table 5) the medium-grained groundmass only was point-counted under the microscope. The percentage of potassic feldspar (maximum 15 percent) phenocrysts was obtained by "point-counting" a photograph of an outcrop surface. In the Ontario Division of Mines classification (Ayres 1972) used by the Ontario Geological Survey the rock is a granodiorite, in the I.U.G.S. classification (Streckeisen 1974) a quartz monzonite, lying very close to the granite field.

MEDIUM-GRAINED, EQUIGRANULAR GRANITIC ROCKS

The pink, medium-grained, equigranular granitic rocks in general underlie the northernmost sectors of all three townships. They appear to be younger

TABLE 5 | MODAL ANALYSES OF FELSIC INTRUSIVE ROCKS.

Rock Type (field name)	Gneissic granite		Porphyritic granite	Medium-grained, equigranular Granite			
Sample number	2A6	1B3	61A17	62A9	70A17D	2B4	10B11
Quartz	26.3	21.4	18.6	34.0	25.5	24.2	31.4
Potassic feldspar	19.5	36.5	30.3	18.6	26.7	28.1	21.0
Plagioclase	40.9	41.8	47.0	44.0	43.1	45.1	45.6
Hornblende	—	—	1.0	—	—	—	—
Biotite	7.8	0.1	0.7	1.5	1.0	0.3	0.2
Muscovite	—	—	—	—	0.3	0.2	—
Sphene	0.4	—	0.1	0.5	—	—	—
Apatite	0.1	—	—	—	—	—	—
Allanite	—	—	—	0.6	—	—	—
Opaque minerals	0.1	0.2	0.2	0.3	0.7	0.2	0.1
Chlorite	0.7	—	0.7	0.4	2.1	0.6	1.7
Epidote	4.2	—	1.4	0.1	0.6	1.3	—
Plagioclase composition	An 25±5	An 28±5	An 28±5	An 28±5	An 30±5	An 25±5	An 25±5
Rock name							
OGS classification (Ayres 1972)	Granodiorite	Quartz Monzonite	Granodiorite	Granodiorite	Quartz Monzonite	Quartz Monzonite	Quartz Monzonite
IUGS Classification Sheckeizen (1974)	Granite	Granodiorite	Quartz Monzonite	Granodiorite	Granite	Granite	Granodiorite
Location							
Easting	471910	472200	463500	463829	465850	470860	471200
Northing	5197520	5196270	5197020	5198130	5199800	5198500	5201880

than the porphyritic granitic rocks because the medium-grained, equigranular rocks contain inclusions of the latter.

In thin section the rocks are seen to be composed of strained quartz, perthitic microcline, partly saussuritized plagioclase, partly or completely chloritized biotite, and 0.1 to 0.7 percent by volume opaque minerals. Epidote and chlorite are common secondary minerals. Allanite was observed in one thin section. Texturally the "granites" are common, massive, granular, and panxenomorphic intrusive rocks.

Four modal analyses and the rock names according to the Ontario Division of Mines and the I.U.G.S. classifications are shown in Table 5. Compositions range from granodiorite to quartz monzonite.

Pegmatite and Aplite

Pegmatite and aplite veins, dikes and irregularly shaped bodies are common in Pre-Huronian rocks. Only a few large pegmatite bodies are shown on the map (back pocket) that accompanies the present report.

The common pegmatite of the area is pink and coarse grained and shows a normal pegmatite mineralogy of quartz, microcline, minor plagioclase, biotite and/or muscovite. In northern and central Botha Township, on the islands in Venetian Lake, the pegmatites are commonly grey and weather white and possibly originated through a remobilization of the quartz porphyry.

Migmatite

A migmatite (Mehnert 1968, p.355) is a "megascopically composite rock consisting of two or more petrographically different parts, one is the country rock in a more or less metamorphic stage, the other is of pegmatitic, aplitic, granitic or generally plutonic appearance".

Only rocks containing more than 50 percent granitic or pegmatitic material were mapped as migmatites in the present area. So defined migmatites were found mainly in the southern part of Rhodes Township. Migmatization in general, however, is common and many exposures of the Early Precambrian metavolcanics and metasediments contain some granitic or pegmatitic material. Photo 8 is a typical migmatite from Kasakawawia Lake (Rhodes Township), showing amphibolite rafts in a granitic neosome.

MAFIC INTRUSIVE ROCKS

Diabase and Glomeroporphyritic Diabase

The Early Precambrian (Archean) metavolcanics, metasediments, and granitic rocks are intruded by numerous mafic dikes. These dikes are 10 cm to 30 m

OGS 10,136

Photo 8–Raft structure migmatite. Location: easting 467080; northing 5193350.

wide. Rarely are they wider. The most common width is 10 to 15 m.

The dikes commonly are vertical. Numerous dikes strike north-northwest but many other directions were also observed. In many places the direction of particular dikes cannot be determined because of lack of continuous outcrop. Bifurcating dikes and dikes cutting each other are present.

The most common type of mafic dike rock is a fine- to medium-grained, equigranular, dark grey diabase that weathers dark greenish grey or dark brown. Margins of the dikes are chilled. Glomeroporphyritic (blotchy) diabase was observed in a few places in all three townships. The light greenish plagioclase aggregates are up to 5 cm (2 inches) in diameter.

In thin section the diabases are seen to be composed of plagioclase, amphibole, epidote, sphene and opaque minerals. In some places quartz, chlorite, leucoxene, biotite and carbonate were observed (see modal analyses, Table 6). The amphibole is a common green hornblende (X = light green; Y = dark green; Z = green; $z \wedge c = 18°$) or an actinolite (X = light yellowish green; Y =

TABLE 6 | MODAL ANALYSES OF EARLY PRECAMBRIAN MAFIC INTRUSIVE ROCKS.

Specimen Number	9A42	21A37	46A22
Quartz	—	3.6	—
Plagioclase	25.4	58.0	11.2
Hornblende	67.9	20.8	—
Biotite	—	—	54.6*
Epidote	6.7	7.2	32.0
Sphene	Tr.	—	—
Leucoxene	—	1.2	—
Chlorite	—	3.8	—
Carbonate	—	—	1.9
Opaque minerals	—	5.4	0.3
Plagioclase composition	An 30-40	An 25-30	very fine grained, untwinned
Location			
Easting	469340	467600	480910
Northing	5196510	5193060	5197940

* K - metasomatism

light green; Z = light green; z ∧ c = 16°). Plagioclase forms saussuritized hypidiomorphic laths or untwinned granoblastic grains. The specimen 46A22 (Table 6) is from a mafic dike that intruded a white pegmatite. It contains much biotite and no amphibole because of a strong potassium metasomatism.

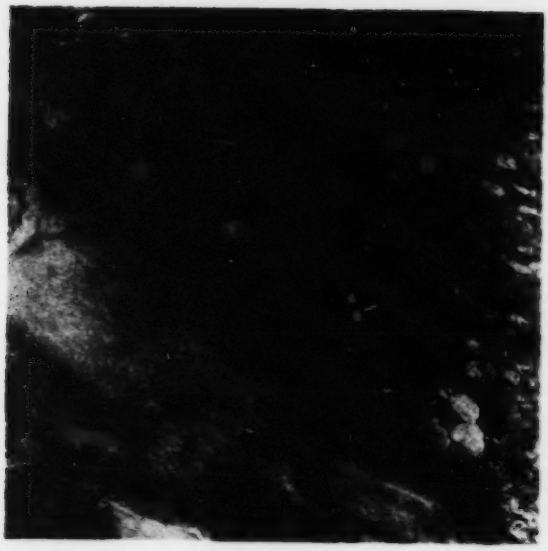
Middle Precambrian

HURONIAN SUPERGROUP

Cobalt Group

Middle Precambrian metasediments of the Huronian Supergroup overlie the older rocks unconformably. The unconformity was observed in several places in the map-area. In many places, however, the Huronian rocks are in fault contact with the older rocks.

During field work no stratigraphic succession could be established because of heavy faulting and because of the lack of continuous outcrop. The classification of the Huronian rocks as Gowganda and Lorrain Formations (Cobalt Group) is therefore based only on lithologic evidence and on the comparison of these rocks with the descriptions given by Meyn (1971; 1973a, b). The system adopted in classification of the sediments is that of F.J. Pettijohn (1975).



OGS 19,137

Photo 9–Gowganda Formation. Conglomerate and fine-grained arkose. Southern Onaping Lake (Munster Township).

GOWGANDA FORMATION

The Gowganda Formation occurs in all three townships and consists of conglomeratic, psammitic, and pelitic rocks. Outcrops of the formation are commonly small and scarce. Therefore no reliable correlation is possible among the various occurrences of Gowganda Formation rocks in the area.

In Emo Township rocks of the Gowganda Formation occur at the southern end of Onaping Lake and near the outlet of this lake. Several small outliers of Gowganda Formation are present west of Onaping Lake in areas underlain by granitic rocks and diabase.

Along the northern shore of Lower Onaping Lake (south of present area) and west of southern Onaping Lake conglomerate, quartz sandstone and arkose in repeated sequences overlie the pre-Huronian basement. The basal member can be either conglomerate or arkose. Individual conglomerate beds (Photo 9) are up to 10 m thick. Pebbles and cobbles are subangular to subrounded, range from 0.5 cm to 30 cm in size and consist of granitic rocks and minor greenstones, quartzites, and siltstones. The conglomerates are unsorted and both paraconglomerate and orthoconglomerate, clast supported (packed) and matrix supported (unpacked), occur. The matrix commonly is a medium-grained greywacke. The quartz sandstones and arkoses in this part of the township form units up to 8 m thick. Individual beds are up to 50 cm thick. The rocks are fine or

medium grained and grey or pinkish grey in colour. Isolated "dropstone" like clasts, mostly granitic rocks, are common.

At the southern shore of Onaping Lake and on nearby located islands the Gowganda Formation appears to be a cyclically repeated, coarsening upward sequence of greywackes, sandstones, and conglomerates.

Three outcrops (A: easting 460290, northing 5193060; B: easting 460500, northing 5193780; C: easting 460900, northing 5193850) were observed that show metasediments up to 25 m thick and that probably represent sections of individual "members", which in like manner coarsen upward. Silty greywacke or fine-grained, small-scale crossbedded arkosic sandstone is overlain by fine- to medium-grained pinkish arkosic sandstone or by graded arkose, that is in turn overlain by conglomerate. The estimated thicknesses of the greywackes, sandstones and conglomerates in the three outcrops A, B, and C are:

		A	B	C
Top	conglomerate	over 2 m (6 feet)	over 1 m (3 feet)	over 8 m (26 feet)
	arkosic sandstone	8 m (26 feet)	2 m (6 feet)	—
	graded arkose	—	—	0.20 m (8 inches)
	greywacke	over 15 m (40 feet)	over 0.15 m (6 inches)	—
Bottom	fine-grained quartz sandstone	—	—	over 0.8 m (30 inches)

The conglomerates of all three outcrops are loosely packed and unsorted orthoconglomerates and consist of subrounded to rounded granite and siltstone clasts set in a fine- to medium-grained greywacke matrix. The size of the clasts ranges from about 1 to 20 cm.

In Rhodes Township the Gowganda Formation occurs on a small island in Richardson Lake and in an area about 1.6 km west of the northern end of this lake.

On the island in Richardson Lake, the formation is a pink, brownish weathering, fine- to medium-grained arkose and a polymictic conglomerate. The matrix of the latter rock is a fine-grained greenish grey greywacke. The clasts are granitic, subangular to subrounded, unsorted and unpacked and range in size from 1 to 50 cm.

West of Richardson Lake loosely packed conglomerates and medium- to coarse-grained arkoses overlie granitic rocks and are in turn overlain by fine-grained greywackes. The clasts of the conglomerate are granitic and angular and are set in a medium-grained arkosic matrix. The overlaying greywacke contains a few granitic "dropstones" that are up to 5 cm in size.

In Botha Township the Gowganda Formation is present on several islands in the northern half of Venetian Lake, about 2 km west of the northwestern arm of this lake and about 0.9 km east of it.

On a big island in northern Venetian Lake, rocks of the Gowganda Formation overlie Early Precambrian quartz porphyries and form an open west-plunging syncline. The formation consists of a grey, grey pinkish weathering arkosic sandstone and minor polymictic conglomerate which are overlain by a laminated, dark grey, light greenish grey weathering silty greywacke. The greywacke includes a paraconglomerate bed of about 0.15 m thickness and some argillitic material. The centre, i.e. the upper most part of the small syncline, is made up of fine-grained, in places 1 to 2 percent by volume, pyrite-bearing, in places magnetite-bearing, laminated quartz sandstone and some greywacke. The coarse clasts in the conglomerate of this sequence are granitic rocks and minor sandstone, volcanic rock, and metagabbro which range in size from 3 to 5 cm up to, rarely, 15 by 30 cm. These subrounded clasts show no sorting or packing. The matrix is a medium-grained chloritic arkose.

The Gowganda Formation 2 km west of northern Venetian Lake is a coarse conglomerate and minor medium-grained arkose overlaying the pre-Huronian granitic basement. About 80 percent of the clasts in the conglomerate are granitic rocks, the remainder are siltstone, sandstone, and greenstone. The clasts are unsorted, loosely packed, subangular to rounded and range in size from under 1 cm to 30 cm.

East of Venetian Lake grey, commonly laminated and, rarely, convolute bedded siltstone and subordinate fine-grained quartz sandstone occur. They are believed to belong to the uppermost members of the Gowganda Formation in the present area. They dip westward and are present east and close to the rocks of the Lorrain Formation.

Modal analyses of four specimens of Gowganda Formation rocks are presented in Table 7.

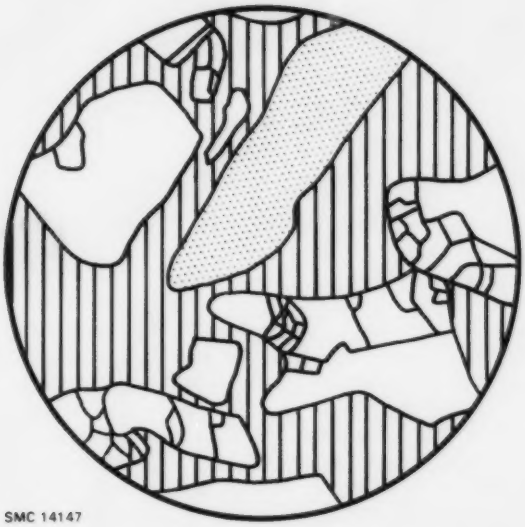
LORRAIN FORMATION

The Lorrain Formation is exposed in all three townships. The thickest section, about 1100 m thick is in southwestern Emo Township. In Rhodes and Botha Townships relatively small areas are underlain by the Lorrain Formation.

No stratigraphic subdivision of the formation could be established in the region and no contact with the underlying Gowganda Formation was observed. In neighboring townships, however, the contact of Lorrain metasediments with the Gowganda Formation is described to be both conformable and gradational in some places, in other places to be disconformable (Meyn 1970; 1971).

In all three townships the rocks of the Lorrain Formation are similar. A quartzitic sandstone is the most common rock type. A layer of siltstone was observed in one place, i.e. 1.6 km west of southern Onaping Lake. The light grey quartz siltstone forms a bed about 30 cm thick in the sandstone. Conglomerates make up about 3 to 5 percent of the formation.

The quartzitic sandstone is grey and weathers grey, greenish, rarely pinkish or brownish red. Individual beds commonly are several metres to several tens of



SMC 14147

Figure 3–Sketch of Lorrain Formation quartzitic sandstone. Quartz and quartzite grains and one plagioclase grain within a fine matrix. Thin section 8A18A. Diameter of field of view is 2 mm. Location: easting 471110; northing 5196260.

metres thick but beds only some centimetres thick or less were also observed. These thinner beds occur in the upper parts of the formation. Small-scale cross-bedding is present in some places e.g. west of Venetian Lake and hematite is concentrated in the lower parts of some crossbed foresets at this location.

From thin section, it can be seen that the grain size of quartz, feldspar, and quartzite fragments ranges from about 0.05 to 3 mm. The matrix (grain size under 0.03 mm) makes up 35 to 50 percent of the rock and, in the grey and greenish grey quartzitic sandstone, consists of finest quartz and feldspar and of a very light brownish and greenish muscovite. The pinkish and brownish red colour of some beds is due to feldspar or to hematite staining.

Conglomerate of the Lorrain Formation is matrix supported (unpacked) and unsorted and forms beds within the quartzitic sandstone that are a few centimetres to 10 m thick. Paraconglomerate and orthoconglomerate occur. The clasts are commonly rounded, up to 5 cm, rarely 10 cm, in size and consist of quartz, quartzite, and minor jasper and are set in a quartz sandstone matrix.

Three modal analyses are shown in Table 7, and Figure 3 shows grain size and shape of one of the modally analyzed specimens.

TABLE 7 | MODAL ANALYSES OF HURONIAN METASEDIMENTS.

Formation		GOWGANDA				LORRAIN		
Rock Name (field name)		Arkose	Arkose	Quartz Sandstone	Greywacke	Quartzitic Sandstone		
Rock name (Pettijohn 1975)		arkosic arenite	arkosic arenite	arkosic arenite	Lithic greywacke	Quartz wacke		
Specimen number		15A13B	41A19B	49A6	59A8	1A8	8A18A*	49A4
Small Rock fragments	granitic				x 24.8			
	volcanic	x 17.0	x 22.1			x (< 5)	x (< 5)	x (< 5)
	quartzite				x 16.3			
	siltstone	x		20.7	41.0	47.0	37.0	37.3
Matrix		39.7	45.1	43.7	10.7	51.9**	54.4**	57.1**
Quartz		15.6	5.6	0.3	5.4	0.5	8.6	1.7
Potassic feldspar		23.1	20.1	23.8	—	—	—	—
Plagioclase		1.8	1.0	10.2	—	—	—	—
Biotite		1.7	5.4	—	0.2	—	—	3.9
Chlorite		1.1	0.7	1.3	1.6	0.6	—	
Opaque ore								
Location								
Easting		478000	482250	483160	460530	472000	471110	483150
Northing		5201690	5200660	5197810	5193690	5196820	5196260	5197800

*Inclusion in Sudbury-type breccia.
**Including < 5% quartzite fragments.

NIPISSING DIABASE

Quartz Diabase

The rocks of the Huronian Supergroup and older rocks are intruded by Nipissing Diabase. In the Blind River area (Van Schmus 1965) and in the Gowganda area (Fairbairn *et al.* 1969) the radiometric ages of these rocks have been determined as 2,150 ± 50 m.y. and 2,160 ± 60 m.y. respectively (Rb/Sr whole rock). The diabase was emplaced "after early faulting during the later stage of an early major folding of the Huronian sequence, but before secondary, deformational events and regional metamorphism" (Card and Pattison 1973, p.8).

In the present area Nipissing Diabase was found in Rhodes and Botha Townships where it forms large irregularly shaped bodies. Intrusive contacts with the Huronian metasediments were observed in one place only, i.e. east of Venetian Lake.

The typical Nipissing Diabase of the map-area is a medium-grained, greenish grey, subophitic metagabbro. In thin section the rock is composed of idiomorphic or hypidiomorphic, commonly lath-shaped plagioclase completely or partly enclosed within actinolitic hornblende that replaced an earlier pyroxene. Accessory quartz, leucoxene, chlorite, and opaque minerals are present. (See Table 8, for modal analyses). No granophyric and pegmatitic phases of the Nipissing intrusions were observed in the area.

The original regional extent and shape of the intrusions in the map-area cannot be determined because of scarcity of outcrop, faulting, and erosion. K.D. Card and E.F. Pattison (1973) describe Nipissing intrusions in the Cobalt-Gowganda areas that have an elliptical outcrop pattern and that have been termed "diabase basins" by R. Thompson (1964). Card and Pattison (1973, p.10-11) state that:

> The distribution pattern and orientation of Nipissing diabase indicates that their emplacement was controlled by pre-existing faults and folds and by lithologic competency of the country rocks. Uniformity of composition and time of emplacement of the intrusions throughout the region implies a common, widespread magma source such as the lower crust or upper mantle.

SUDBURY-TYPE BRECCIA, PSEUDOTACHYLITE, AND ULTRAMYLONITE

Figure 4 is a location map showing the occurrences of pseudotachylite, ultramylonite, and breccia. The best exposures of breccia are on the shorelines of Bennet, Kawawia, Richardson, and Venetian Lakes and on an island in eastern Onaping Lake. No breccia was found in the northern part of the map-area. Ultramylonite and pseudotachylite occur in all of the map-area.

Sudbury-Type Breccia

The breccia consists of subangular or subrounded fragments set in a fine-grained or aphanitic matrix (Photo 10 and Figure 5). It follows in general the

Figure 4–Location of Sudbury-type breccia, ultramylonite, and pseudotachylite.

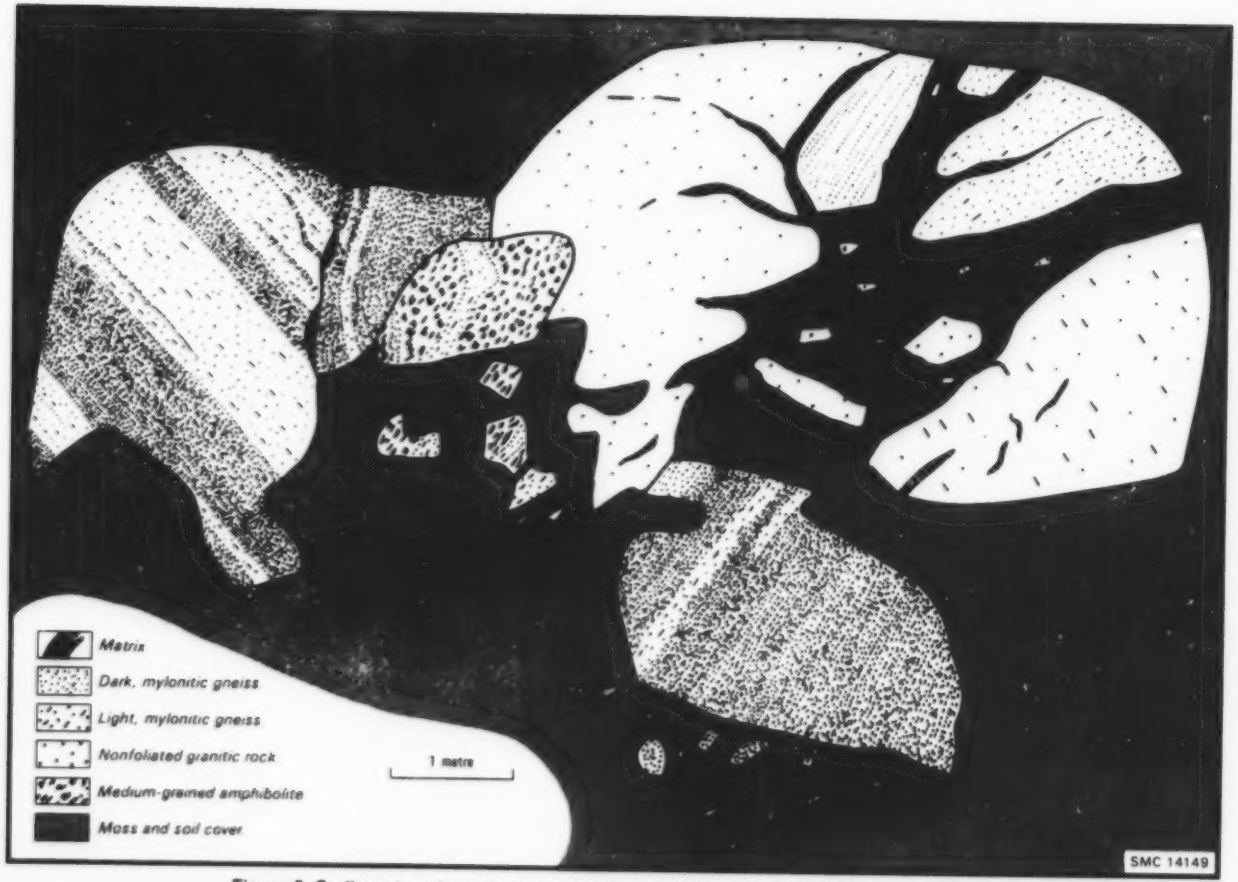


Figure 5–Sudbury-type breccia. Location: Bennet Lake, easting 471200; northing 5193940.

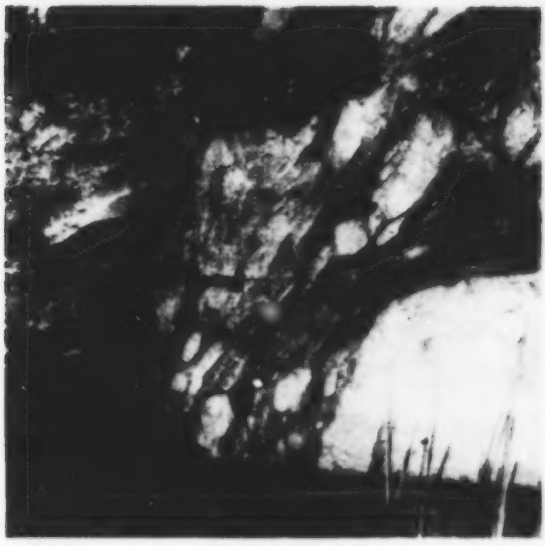


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Photo 10–Sudbury-type breccia. Location (Bennet Lake): easting 472200; northing 5193380.

trend of the rock units in which it occurs. The contacts of the breccia with the host rocks were rarely observed because of lack of continuous outcrop, where exposed, however, they are sharp. The fragments are commonly locally derived, but transportation for considerable distances, i.e. some hundreds of metres, is necessary to account for the occurrence of others. Inclusions of Huronian sedimentary rocks were observed in breccia that intruded Early Precambrian (Archean) metavolcanics. The colour of the matrix is commonly darker than the host rock or the colour of the fragments. Fine lines, parallel to big fragments or curving around smaller ones, were noted in some matrices.

In thin section the matrix consists of mineral fragments that range in size from some millimetres down to the resorbing power of the light microscope. The most common mineral fragments are quartz and feldspar. They are commonly angular and cracked and exhibit a wavy extinction. Shock metamorphic features seem to be absent. Biotite and actinolite are common in the matrices. They are of metamorphic origin as they are not kinked or bent and biotites are parallel to a weak foliation and mark flow lines. Epidote, chlorite, and opaque minerals were also observed. The matrix always contains more mafic minerals than the host rocks.

The brecciation produced little overall chemical change. Card (1968, p.43) states, that "there is a general increase in total iron, and particularly ferrous iron, going from breccia fragments to matrix. In addition, there is possibly an increase in MgO and CaO, and a decrease in K_2O".

ORIGIN OF THE BRECCIA

The breccia found in the present area are of the same kind that were described as Sudbury type breccia by H.W. Fairbairn and G.M. Robson (1941), E.G. Speers (1957), K.D. Card (1975), and many others. The origin of the breccia has been and still is a matter of debate.

Fairbairn and Robson (1941, p.31-33) state that the Sudbury breccia is a structural breccia, formed by a combination of movement and hydrothermal activity. It is not a volcanic breccia because "the age of the breccia is definitely fixed in the time scale", and "no unbrecciated rocks of volcanic origin and of that age are known at Sudbury. Furthermore, only one volcanic fragment has been found in the matrix". "The matrices are too rich in quartz to have been molten during their formation unless unusual temperatures are assumed". They also state that "the close chemical and mineralogical relation between matrix and host rock or fragments makes a volcanic origin quite untenable". Fairbairn and Robson also reject the possibility of a replacement origin of the Sudbury breccia.

Speers's (1957, p.513) theory of the origin of the Sudbury breccia is as follows:

> ... Forces accompanying the Killarnean mountain-building were instrumental in forming a great dome structure in the Huronian and older rocks, which in turn was instrumental in guiding magma toward its apex. The central core of crystalline rocks was thrust upward as if by a punch from below, possibly by forces which resulted from magmatic action in the deeper parts of the structure, and Sudbury breccias were formed in the resulting tension fractures. This may have been followed by the intrusion of Nipissing gabbros into the early-formed breccias. After the Nipissing gabbros had solidified, the central core of older rocks was again driven bodily upward, and gaping tension fractures developed on the old surface, especially along the old contacts. Volcanic gases burst through the center of the dome along major rifts and thus ushered in one of the most violent periods of explosive volcanic activity ever recorded in the rocks of the earth's crust. The actual eruption was continuous and may have taken place in a relatively short period of time. Tilting and undulation of the surface, resulting from the eruption, caused multitudes of tension fractures to open and to close like jaws on giant crushers ....

B.M. French (1968) describes shock metamorphic features in rocks of the Sudbury structure as evidence for an origin of the structure by meteorite impact. He states (1968, p.409) that Speers's description of the breccias could, without serious modification, apply to the explosive aftereffect of a large meteorite impact.

The debate over the origin of the Sudbury breccia is a debate over the origin of the Sudbury structure. Essentially there are two theories: The Sudbury structure was formed by explosive volcanism or by the impact of a large meteorite.For further information the reader is referred to R.S. Dietz (1964), French (1968), Card and Hutchinson (1972), and Card (1975).

PSEUDOTACHYLITE AND ULTRAMYLONITE

Pseudotachylite and ultramylonite are most common in the southern third of the map-area but were also observed north of the region in Sweeny Township.[1]

Pseudotachylite is a vein rock produced by extreme mylonitization and externally resembles tachylite (Shand 1916). On the origin of the pseudotachylite S.J. Shand states: "The pseudotachylite has originated from the granite (= host rock) itself through melting, caused (as I have shown) not by shearing but by shock, or alternatively, by gas fluxing".

In the present area rocks are termed pseudotachylite that show a kind of flow texture and that cut through their host rock in almost every direction. Major "dikes" are up to 60 cm wide, show subangular to rounded inclusions of the host rock, and thin apophysis-like injection of matrix from the "dikes" into the host rock. The contacts with the host rocks are always sharp. The matrix is very fine grained or aphanitic and greenish grey or dark grey. In thin section it is undistinguishable from matrices of the Sudbury-type breccia. Glass or devitrified glass and shock metamorphic features were not observed in the matrix, the inclusions, or the host rocks. Chemical investigation (Card 1975, personal communication) shows that the chemical composition of the pseudotachylite reflects the composition of the host rocks.

The pseudotachylite is believed to be of the same origin as the Sudbury-type breccia, i.e. they are related to the "Sudbury Event", either the impact of a meteorite or an explosive volcanism.

Ultramylonite is very fine grained to aphanitic, dark greenish grey or black mylonite (Photo 11). They show no internal textures, with the exception of a fine lamination in a few places, and no apophyses into the host rocks. They originated through shearing caused by regional tectonic forces or by the rebound or isostatic readjustment of bedrock blocks after the "Sudbury Event".

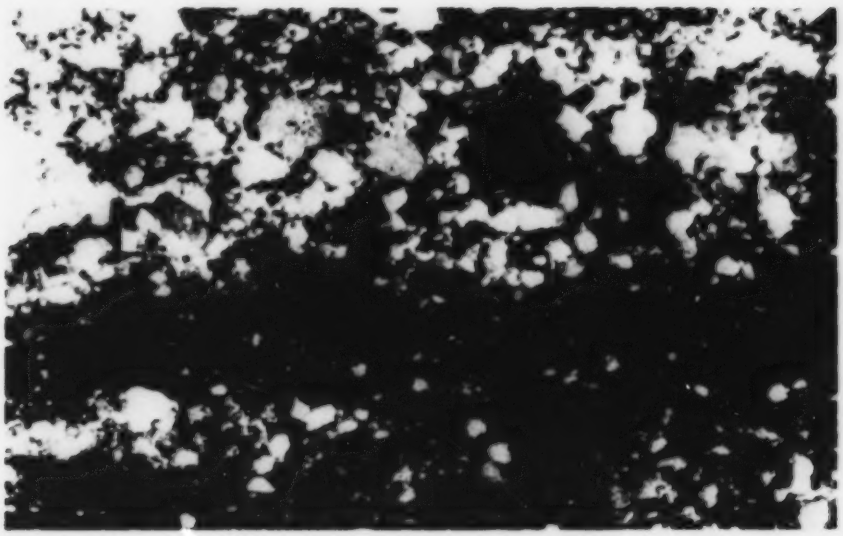
Middle to Late Precambrian

MAFIC INTRUSIVE ROCKS

Olivine Diabase

Olivine diabase occurs in all three townships. It commonly forms northwest-trending dikes. The dikes produce no distinctive magnetic anomalies in the area and weather easily. Therefore it was not always possible to trace them for long distances.

[1]The best outcrops of pseudotachylite are about 2.4 km west of southern Richardson Lake; easting 469380; northing 5195260.



OGS 10,139

Photo 11–Photomicrograph of ultramylonite (dark) in cataclastic aplitic granite. Thin section 5A34A. Scale 0.2 mm. Location: easting 469290; northing 5195250.

Most of the olivine diabases are medium grained, grey and weather brown. Locally they display spheroidal weathering. Porphyritic varieties, containing plagioclase phenocrysts up to 2 by 3 cm in size and set in a medium-grained groundmass were noted in a few places.

A fine-grained, fresh looking mafic dike of about 60 cm in width was observed in the Lorrain quartzitic sandstone west of southern Onaping Lake. Because of the lack of an apparent alteration it was classified as Late Precambrian. In hand specimen the rock does not show any olivine.

The typical medium-grained olivine diabase consists of idiomorphic plagioclase, xenomorphic olivine, and purplish augite. In places the plagioclase is saussuritized, in places it is not. The augite of the (northern) Venetian Lake olivine diabase shows purplish cores and somewhat greenish rims. Minor amounts of a very dark brown to light brown biotite, chlorite, long and thin, idiomorphic, in places hollow apatite, and opaque minerals are present. The texture is ophitic (Figure 6). Table 8 presents three modal analyses of olivine diabases.

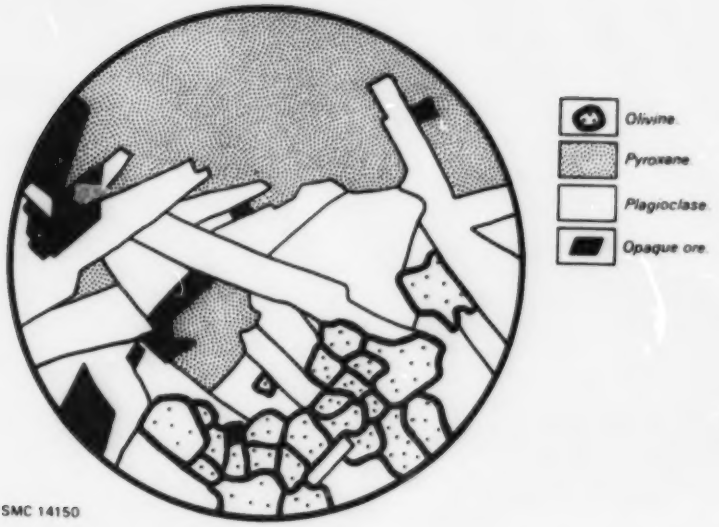


Figure 6–Sketch of olivine diabase. Diameter of field of view is 2 mm. Location: easting 481500; northing 5201810.

TABLE 8 | MODAL ANALYSES OF POST-HURONIAN MAFIC INTRUSIVE ROCKS.

Rock name	Nipissing Diabase		Olivine Diabase		
Sample Number	14A6	14A8	38A6	1B6	72B8
Quartz	2.9	1.1	—	—	—
Plagioclase	60.2	49.3	65.9	61.0	63.5
Olivine	—	—	8.7	14.3	15.4
Pyroxene	—	—	8.2	11.1	9.8
Actinolitic hornblende	34.6	42.6	—	—	—
Biotite	—	—	2.5	2.5	1.4
Apatite	—	—	1.5	1.4	1.1
Opaque minerals	0.8	0.7	10.1	9.2	7.6
Epidote	—	5.8	—	—	—
Chlorite	0.1	0.5	3.1	0.5	1.2
Leucoxene	1.4	—	—	—	—
Plagioclase composition	An 55±5	An 55±5	An 63±5	An 60±5	An 65±5
Location					
Easting	475240	476700	481500	472420	462740
Northing	5197460	5198250	5201810	5195630	5202050

Cenozoic

QUATERNARY

Pleistocene and Recent Deposits

The Cenozoic sediments in the map-area were deposited mainly during the Pleistocene when continental glaciers invaded the area several times from the north. When the last glaciers receded they left behind glacial and glaciofluvial deposits of till, sand, and gravel. Two small eskers were observed, one in Emo and one in Botha Township.

The direction of the movement of the last glaciers is recorded by glacial striae and generally trends north-south.

Recent sediments are beach deposits along lake shores, clay, sand, and gravel deposited in lakes and streams and peat deposits in swamps. The largest swamps are in the southern sectors of the townships.

Figure 7 is a sketch map showing the general distribution of Pleistocene and Recent deposits and the strike of glacial striae.

STRUCTURAL GEOLOGY

Figure 8 is a sketch map showing the major structural elements of the area. The rocks of the southern part of the area, i.e. the Early Precambrian gneisses, metavolcanics, and metasediments are strongly foliated. The granites and diabases of the northern part of the region in general are little or undeformed and were subjected only to heavy faulting. This faulting has effected all the rocks of the map-area and must have been active from the Early to the Late Precambrian.

Several phases of deformation can be recognized studying the regional geology, hand specimens, and thin sections. Early Precambrian gneisses and inclusions of these gneisses within the Sudbury-type breccia are, in places, blastomylonitic indicating two pre-breccia deformations. The breccias themselves originated during another tectonic event. Another deformation caused a weak foliation of the matrix of the breccia. The Huronian rocks are weakly deformed and metamorphosed but there is no field evidence for classifying these features as pre- or post-breccia. Middle to Late Precambrian, i.e. post-breccia olivine diabases were subjected to faulting as seen in neighboring Beaumont Township (Meyn 1973).

Folds

The pre-Huronian metavolcanic-metasedimentary sequence has been folded in a steeply dipping or vertical position.

Exposed bedrock and thin discontinuous moraine.

Glacial and fluvioglacial deposits; <15% exposed bedrock.

Swamp.

Glacial striae

Esker

Miles
0 1 2 3
0 1 2 3 4 5 6
Kilometres

SMC 14151

Figure 7–Pleistocene and Recent Geology.

The Huronian metasediments are weakly deformed and broad, open folds occur but are uncommon. They were observed west of southern Onaping Lake and on an island in north-central Venetian Lake.

Faults, Joints, and Other Features of Rock Deformation

Four principal directions of major faults and of topographic lineaments were observed: north-northwest (Sandcherry and Fecunis Lake Faults), northwest (Michaud Fault) and, less important, northeast.

North of Richardson Lake in Rhodes Township the granites are in contact with Huronian rocks and with the Early Precambrian metavolcanics along an east-striking fault. Along some of these major faults, for example in southern Rhodes Township, a strong mylonitization was observed.

Minor faults and joints are numerous throughout the area. Figure 9 is a stereogram showing the joint pattern in the granites of northern Emo and Rhodes Townships. Most joints are vertical or dip steeply and the principal directions as the principal directions of the major faults are north-northwest and northwest. A weak maximum exists for northeast-striking and 10 to 30 degrees northwest-dipping joints.

Cataclastic and mylonitic rock textures are common mainly in the southern part of the region. They are described on page 5 (biotite plagioclase gneisses). They are older than the Sudbury-type breccia, ultramylonites and pseudotachylites that were also observed mainly in the southern sectors of the map-area.

Shock metamorphic features seem to be absent from all investigated rocks. Several thin sections of the Sudbury-type breccia and of pseudotachylites were carefully studied.

In a very few places Böhm lamellae (Böhm 1883) in quartz of the Early Precambrian metasedimentary-metavolcanic suite of rocks were observed. The lamellar microstructures are (0.1 to 1.0) x 10^{-3} mm thick and show an optical orientation somewhat different from the rest of the quartz crystal. Böhm lamellae are known from naturally deformed rocks and are wider than the "deformation lamellae" found in shock metamorphosed rocks in meteorite impact craters and crypto-explosion structures (Carter 1968).

CORRELATION BETWEEN GEOLOGY AND AEROMAGNETIC DATA

Geological Survey of Canada Aeromagnetic Maps 1519G (Venetian Lake) and 1525G (Pogumasing) include the map-area (CGS 1965a,b). A number of magnetic features can be related to the bedrock geology.

The magnetic contrast over the terrain underlain by gneisses, granitic rocks, rocks of the Huronian Supergroup, and Nipissing Diabase commonly is low. Gamma values are about 2,000 to 2,200 and isomagnetic lines are widely spaced over areas underlain by these rocks. In northern Rhodes Township magnetic

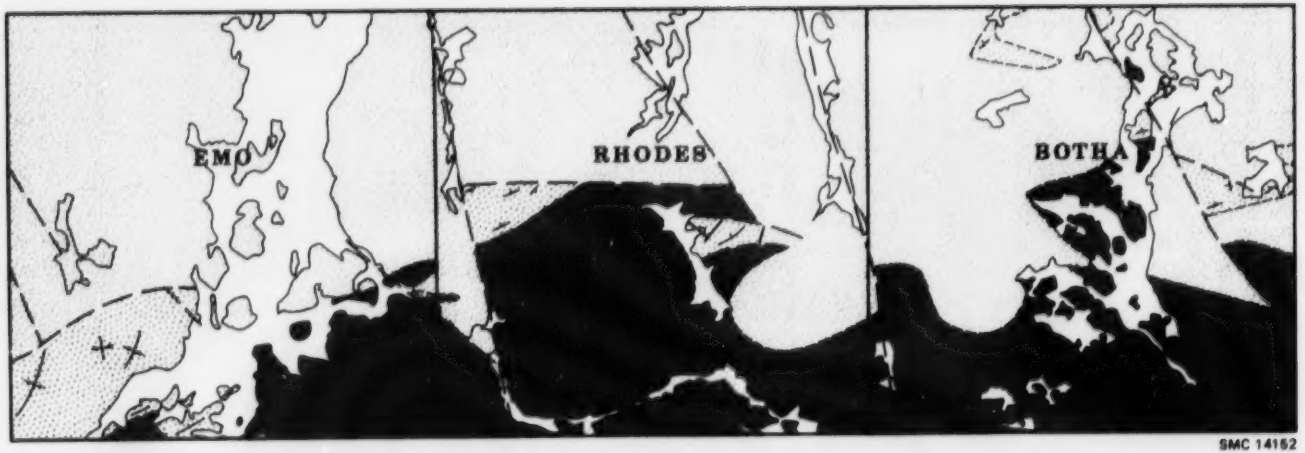


Figure 8–Major structural features.

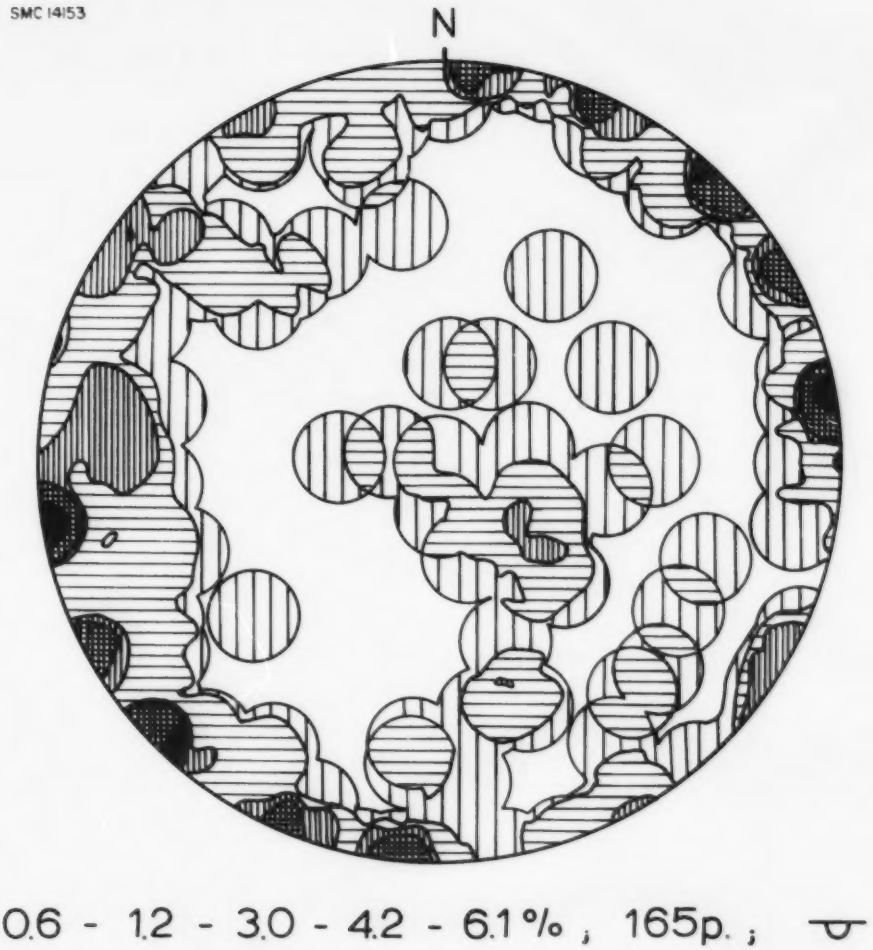


Figure 9–Stereogram for joints in the granitic rocks of northern Emo and Rhodes Townships.

anomalies exist over granitic rocks (2,200-2,400 gammas) and are possibly caused by mafic inclusions in the granites.

In the southern part of the map-area isomagnetic lines reflect in general the regional trend of the iron formation. The iron formations cause an east-trending anomaly that extends, with a break over southern Venetian Lake, westward from McGrindle Lake to Sandfly and Bennet Lakes and from Bennet Lake northwestward for about 6.5 km where it ends 1.2 km east of the Fecunis Lake Fault. West of this fault and 1.6 km to the south, the east-trending anomaly can be traced for a short distance over southeastern Onaping Lake.

A magnetic anomaly (2,600 gammas) 2.4 km north of McGrindle Lake is over mafic volcanics that, in places, are magnetite-rich. Another anomaly (2,575 gammas) is present over granitic terrain about 0.8 km east of Friday Lake.

ECONOMIC GEOLOGY[1]

Several bands and lenses of iron formation occur in the southern parts of the three townships. Hematite and minor magnetite mineralization of hydrothermal origin has been found in granite east of Onaping Lake. A lead, zinc, and minor copper mineralization is located west of Venetian Lake. Sand and gravel is available in the map-area.

Iron

IRON FORMATION

An irregular and discontinuous belt of magnetite iron formation extends from McGrindle Lake westward to Sandfly and Bennet Lakes, from this lake northwestwards to an area northwest of Richardson Lake, and to southeastern Onaping Lake. It occurs in metavolcanics and is part of "The Iron Belt West of Hutton" Township examined by M.T. Culbert in 1903 (Culbert 1904). A petrographic description of the iron formation is presented in the subsection "Iron Formation", under "Metasediments" in the "General Geology" section of this report.

[1]All information on the economic geology of the deposits in this section is from the: Assessment Files Research Office, Ontario Geological Survey, Toronto; the Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury; and from field observations of the author.

Description of Deposits[1]

BENNET LAKE OCCURRENCE [1962] (3)[2]

In 1962 Ironco Mining and Smelting Limited held a group of 60 claims north of Bennet and Kasakawawia Lakes in Rhodes Township. Efforts were concentrated on three claims north of Bennet Lake where the company conducted a magnetometer survey and from where it reported outcrop of irregularly folded iron formation from which a grab sample is reported by the company to have contained 28.5 percent Fe. The geophysical survey indicates two irregular lenses of iron formation across a width of 120 m for a total length of 550 m. The claims were allowed to lapse.

HANNA OCCURRENCE (4)

("Bennet Lake Property")

The four claims (S291382, S291387, S323303, and S323304) of The Hanna Mining Company are located north of Kawawia and east of Bennet Lake.

The company (1972) conducted magnetic and electromagnetic surveys and reported a band of iron formation crossing the property near its north boundary. The company drilled a 45.1 m deep hole in claim S291382 but did not encounter iron formation and "nothing of economic significance appears to be related to the magnetic anomalies located on the Bennet Lake grid system" (Assessment Files Research Office, Ontario Geological Survey, Toronto). The claims were still in good standing as of December 1975 but no further work had been recorded.

T. HOLMSTROM

North Lake (8)

No assessment file information is available on two claims (S60954, S60955) held by T. Holmstrom since 1952 in Botha Township. The property is northeast of the ground formerly held by Explorers Alliance Limited (Sandfly Lake Occurrences Nos. 7,11).

[1] The term "deposits" is used as a general term to include "mine", "prospect" and "occurrence".

[2] Numbers in brackets after each deposit name refers to the deposit number on Map 2413 (back pocket).

McGRINDLE LAKE OCCURRENCE [1962] (10)

This occurrence of iron formation located in Botha Township at the north end of McGrindle Lake has been explored by trenching and geophysical methods and it had been staked several times (Assembly Mines Limited, 1959; Ironco Mining and Smelting Limited, 1962; R. Charron, 1974).

Ironco Mining and Smelting Limited traced the irregular band of iron formation by a magnetometer survey across five claims for a distance of about 1.77 km and discovered a smaller second band of iron formation, which is not exposed, south of the first. Assembly Mines Limited reported an analysis of 32.63 percent Fe obtained from character samples taken at 3 m intervals from a 36.5 m trench. The ground was last held by R. Charron in 1974 but as of October 16, 1975 was open for staking.

RICHARDSON LAKE OCCURRENCE [1971] (6)

In Rhodes Township about 1.9 km west of northern Richardson Lake a northwest-striking and steeply northeast-dipping band of iron formation has been traced for 1.86 km.

In 1962 Ferco Mines Limited tested the occurrence by a magnetometer survey, by trenching, stripping, and sampling. The company reported a width of 21 to 23 m for the iron formation. Chemical analyses vary from 30 to 60 percent soluble iron. The average grade as reported by the company is 45 percent Fe.

In 1966 H.E. Smith drilled six diamond drill holes, but only four of the six holes, totalling a depth of 128 m have been recorded. The locations (2 holes easting 46800, northing 5197150; 2 holes easting 468630, northing 5196990) of these four holes are indicated on Map 2413 (back pocket). The drill encountered two bands of iron formation in greenstones, one band being 2.1 to 7 m, the other 15.2 to 21.3 m thick. The iron formation of the thinner band analyzed 12.2 percent, 46.72 percent, and 49.2 percent Fe_2O_3 (The iron formation encountered in the fourth hole was not analyzed).

In 1969 Erana Mines Limited carried out some bulldozer stripping and in 1971 Richardson Lake Iron Mines Limited drilled two holes (total 50.8 m) in its claim S151387 intersecting greenstones and two bands of iron formation. The location easting 469350, northing 5196510 is indicated on Map 2413 (back pocket). In 1975, during the present mapping program, the occurrence was unstaked and the author of this report measured a section across the outcrop of the formation (see Figure 2) in the former claims of Richardson Lake Iron Mines Limited.

SANDFLY LAKE OCCURRENCE [1957] (7,11)

In the southern part of Rhodes Township and in the southwestern sector of Botha Township prospecting for iron has been carried out without great success. In 1957 Explorers Alliance Limited investigated the areas between Kawawia and Sandfly Lakes and north and northeast of the latter lake. It conducted a magne-

tometer survey and reported magnetic anomalies which represent occurrences of iron formation 1.6 km northeast of Sandfly Lake and 0.8 km west of the north end of this lake. Four holes were drilled and the company reported an analysis of 39.72 percent Fe. No exact location or diamond drill records were found in the assessment files and no outcrop of iron formation was encountered in the densely overgrown area during the present investigations.

TURCOTTE BAY OCCURRENCE (2)

Two small occurrences of magnetite iron formation were discovered by the author in Emo Township, one on the south shore of Turcotte Bay, the other on a nearby island.

The occurrence on the shore of Turcotte Bay is a 2 x 3 m outcrop of banded chert magnetite iron formation. No other rocks are exposed at this locality and the formation could be traced with a dip needle for about 50 m in both directions. It strikes east-west, i.e. in both directions from the outcrop into Onaping Lake.

On the island the magnetite iron formation forms beds in mafic metavolcanics. The beds are up to 30 cm thick and the total thickness of all iron-rich layers appears to be only 45 to 60 cm. The formation is exposed on the western shore of the island, strikes east, and dips about 70 degrees to the south. It is not exposed at the eastern shore of the island.

HYDROTHERMAL HEMATITE AND MINOR MAGNETITE MINERALIZATION IN GRANITE

Description of Deposits

Hematite and minor magnetite mineralizations have been found in cataclastic and commonly deep red granite that, in many places, is cut by quartz-magnetite and quartz-hematite veins. Both types of mineralization, i.e. the impregnation of the host granite with hematite and magnetite (Figure 10) and the mineralized veins occur along and up to 0.4 km east and west of the Fecundis Lake Fault. The primary source of the iron was probably inclusions of iron formation within the granite that was remobilized by hydrothermal fluids during faulting. The southernmost occurrence of hematite-rich granite is close to an inclusion of iron formation and metavolcanics.

ONAPING LAKE OCCURRENCE [1951] (1,5)

In 1950 A. Anderson (2 claims) and T. Holmstrom (5 claims) staked hydrothermal hematite and minor magnetite mineralization 3.5 km east of Onap-

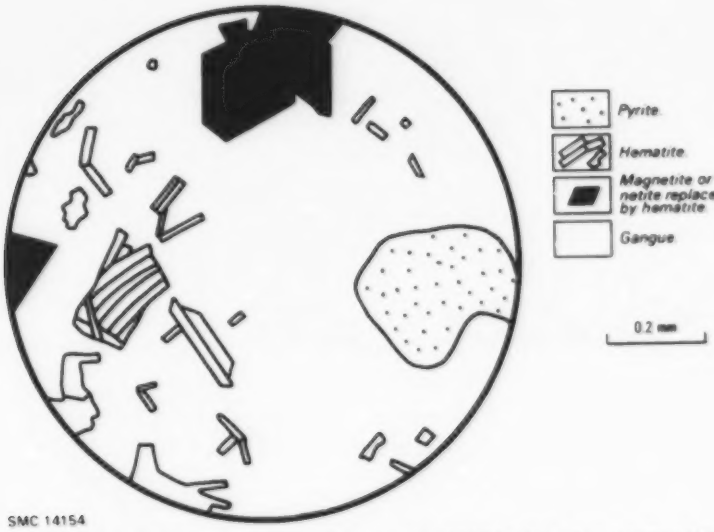


Figure 10–Sketch of mineralized granite. Thin section 69A24B. Location: easting 465910; northing 5197680.

ing Lake in eastern Emo and western Rhodes Townships. The main mineralized breccia zone (easting: 465910, northing: 5197680)) trends northward, lies within the Fecundis Lake Fault and is about 60 m long and up to 6 m wide and contains 30 to 40 percent hematite. The dip of the mineralized zone is not known.

In 1951 Head of the Lakes Iron Limited acquired an option to purchase the claims and in 1952 carried out gravimetric and magnetometer surveys and diamond drilled eight holes for 849 m. The result of these surveys is not known but presumably nothing of economic importance was found and the option was later dropped. No further work was reported and the claims were allowed to lapse.

Lead, Zinc, and Copper

Minor, i.e. not more than 0.5 volume percent, disseminated pyrite occurs in several places in the Early Precambrian metavolcanics. One occurrence of sulphide mineralization has attracted the interest of prospectors and mining companies and is currently held by T. Holmstrom.

T. Holmstrom
Venetian Lake (9)
(Claims S80132, S80133, and S80134)

The T. Holmstrom property is located west of Venetian Lake in central Botha Township and is underlain by northwest-striking mafic and intermediate to

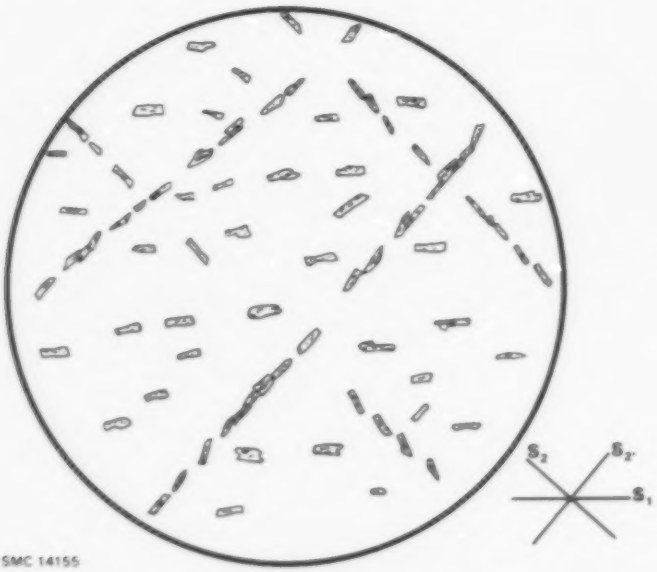
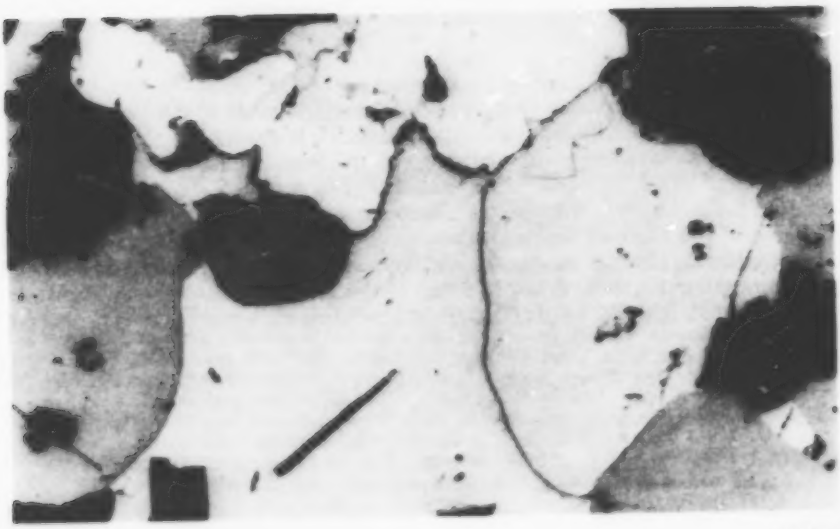


Figure 11–Biotite forms an open S_1 and a set of S_2 and $S_2{}^1$ foliations in felsic metavolcanic. Field of view is 2 mm. Thin section 43A5A. Location: T. Holmstrom (9) property, easting 478950; northing 5197950.

felsic metavolcanics. The main mineralization on the property appears to lie at a contact between mafic and felsic metavolcanics.

In 1938 Canamanscano Mining Syndicate carried out a geophysical survey on this prospect for T. Holmstrom and Associates. In 1949 J. E. Thomson, provincial geologist, collected several samples from the occurrence for chemical analyses. Samples taken by Thomson from the main trench near Venetian Lake were reported to contain (Assessment File Information, letter of J.E. Thomson to T. Holmstrom): Pb 8.53 percent; Zn 11.74 percent; Cu 0.53 percent; Ag 2.91 ounces per ton; Au 0.01 ounce per ton. Following this, little was done until 1951 when Osisko Lake Mines Limited obtained an option on the prospect, explored the ground, and diamond drilled eight holes (3,172 feet). Whereas this work showed scattered mineralization containing low values in zinc, lead, and silver occurring over considerable widths and over 91 m strike-length, in no case was the grade high enough to be of economic interest at that time, and the option was, therefore, dropped.

In 1975 the author of this report visited the property. Outcrop in the property is poor and most trenches are overgrown. In the main trench near Venetian Lake some specimens for microscope and chemical investigations were collected. The fine-grained host rock is laminated, grey and light grey weathering rhyolite. In thin section it is seen to be composed of quartz, plagioclase, minor microcline, biotite, muscovite, opaque minerals, and traces of sphene. Biotite is brown to dark brown and forms an open S_1 and a set of S_2 and $S_2{}^1$ foliations (Figure 11).



DGS 10,140

Photo 12–Photomicrograph of mineralized felsic metavolcanic. Polished thin section 43A5C. Py - pyrite; P - pyrrhotite; Zn - sphalerite; Pb - galena; Pl - plagioclase; Bi - biotite. Scale 0.05 mm. Location: T. Holmstrom (9) property, easting 478950; northing 5197950.

Quartz and feldspars are recrystallized and grain boundaries are straight or slightly curved. Grain sizes are inhomogeneous suggesting a fragmental origin of the rock. The opaque ore minerals are galena, sphalerite, pyrrhotite, and pyrite (Photo 12). In polished section a little chalcopyrite was also observed. A modal analysis and a chemical analysis of the rhyolitic host rock (specimens 43A5A and 43A5B) are presented in Tables 3 and 4.

The mineralized zone is exposed only in the main trench; drill core is not available; and the information from the recorded drill sections is not very satisfactory. Based on these drill records and on field observations the mineralized zone appears to strike northwestward over a length of 0.09, possibly 0.3 km, and dips to the southwest. Quartz porphyry is exposed to the east of the zone and mafic metavolcanics to the west and the mineralized zone appears to be at the contact of the two units.

The claims were in good standing as of October 16, 1975.

Sand and Gravel

Sand and gravel is available in the map-area and the best deposits, suitable for road construction, occur in the southern parts of the map-area, mainly south of Venetian Lake and around Sandfly Lake.

Suggestions for Future Exploration

Much of the prospecting to date has been restricted to surface and near surface exploration and detailed exploration could be rewarding in the map-sectors underlain by metavolcanics in particular at the felsic to intermediate metavolcanic (quartz porphyry) and mafic metavolcanic contacts (see T. Holmstrom, Venetian Lake, Deposit Number 9). These metavolcanics are the northeastward extension of the rocks in which the past-producing lead-zinc Geneva Lake mine of Genex Mines Limited occurs (Card 1969, Map 2170). No indications of uranium mineralization were noted in rocks of the Huronian Supergroup, however, the potential should not be overlooked and radiometric surveys could be rewarding.

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